Radioactivity in the Risø District July-December 2014

Nielsen, Sven Poul; Andersson, Kasper Grann; Miller, Arne

Publication date:
2015

Document Version
Publisher's PDF, also known as Version of record

Radioactivity in the Risø District July-December 2014

DTU Nutech Report

Sven P. Nielsen, Kasper G. Andersson and Arne Miller
DTU-Nutech-10(EN)
June 2015

DTU Nutech
Center for Nuclear Technologies

Author: Sven P. Nielsen, Kasper G. Andersson and Arne Miller
Title: Radioactivity in the Risø District July-December 2014
Division: Radiation Research

DTU-Nutech-10(EN)
June 2015

Abstract (max. 2000 char.): The environmental surveillance of the Risø environment was continued in July - December 2014. The mean concentrations in air were: 0.31±0.24 μBq m^{-3} of ^{137}Cs, 2.70±1.13 mBq m^{-3} of ^{7}Be and 0.28±0.22 mBq m^{-3} of ^{210}Pb (±1 S.D.; N = 26). The depositions by precipitation at Risø in the second half of 2014 were: 0.056 Bq m^{-2} of ^{137}Cs, 730 Bq m^{-2} of ^{7}Be, 76.7 Bq m^{-2} of ^{210}Pb and < 1.2 kBq m^{-2} of ^{3}H. The average background dose rate (TLD) at Risø (Zone I) was 42 nSv h^{-1} compared with 51 ± 5 nSv h^{-1} (±1 S.D.; N = 4) in the four zones around Risø.

ISBN: 978-87-997857-0-4

Contract no.:

Group's own reg. no.:
59514 E-1

Sponsorship:

Cover :

Pages: 24
Tables: 14
References:

Center for Nuclear Technologies
Technical University of Denmark
P.O.Box 49
DK-4000 Roskilde
Denmark
Telephone +45 46775300
www.dtu.dk

Contents

Table 1. Radionuclides in ground level air collected at Risø (cf. Figs. 1, 1.1 and 1.2), July - December 2014. (Unit: $\mu Bq\ m^{-3}$)

Date		^{7}Be	^{137}Cs	^{210}Pb
30-Jun-14 –	07-Jul-14	5458	0.169	378
07-Jul-14 –	14-Jul-14	5082	0.282	259
14-Jul-14 –	21-Jul-14	2762	0.075	144
21-Jul-14 –	28-Jul-14	5417	0.332	368
28-Jul-14 –	04-Aug-14	3157	0.161	231
04-Aug-14 –	11-Aug-14	3409	0.116	162
11-Aug-14 –	18-Aug-14	2140	0.074	76
18-Aug-14 –	25-Aug-14	1706	0.068	61
25-Aug-14 –	02-Sep-14	2374	0.130	174
02-Sep-14 –	08-Sep-14	2658	0.522	382
08-Sep-14 –	17-Sep-14	2932	0.409	329
17-Sep-14 –	22-Sep-14	3066	0.797	524
22-Sep-14 –	29-Sep-14	2807	0.109	121
29-Sep-14 –	06-Oct-14	2847	0.507	336
06-Oct-14 –	14-Oct-14	2827	0.510	197
14-Oct-14 –	20-Oct-14	1763	0.107	124
20-Oct-14 –	27-Oct-14	1802	0.138	133
27-Oct-14 –	31-Oct-14	2502	0.263	187
31-Oct-14 –	10-Nov-14	1874	0.188	375
10-Nov-14 –	17-Nov-14	2366	0.756	986
17-Nov-14 –	24-Nov-14	1513	0.740	704
24-Nov-14 –	01-Dec-14	2787	0.476	327
01-Dec-14 –	08-Dec-14	2616	0.642	599
08-Dec-14 –	15-Dec-14	1499	0.107	55
15-Dec-14 –	22-Dec-14	1122	0.094	39
22-Dec-14 –	30-Dec-14	1640	0.338	121
Mean		2697	0.312	284
SD		1132	0.236	222

Table 2.1. Radionuclides in precipitation in the 10 m^2 rain collector at Risø (cf. Fig. 1), July - December 2014. (Unit: Bq m^{-3})

Month	^{7}Be	^{137}Cs	^{210}Pb
July	2358	0.240	94
August	1694	0.071	111
September	1843	0.185	196
October	1334	0.065	128
November	2315	0.422	744
December	984	0.034	54

Table 2.2. Radionuclides in precipitation in the 10 m^2 rain collector at Risø (cf. Fig. 1), July - December 2014. (Unit: Bq m^{-2})

Month	Precipitation (m)	^{7}Be	^{137}Cs	^{210}Pb
July	0.037	88	0.0079	3.5
August	0.064	108	0.0046	7.2
September	0.091	168	0.0169	17.8
October	0.141	189	0.0088	17.4
November	0.034	79	0.0144	25.4
December	0.099	98	0.0033	5.4
Sum	0.466	730	0.0559	76.7

Table 2.3. Tritium in precipitation collected at Risø (cf. Figs. 2.3.2 and 8.1) July - December 2014. (Unit: kBq m^{-3})

Month	10 m^2 rain collector*
July	2.6
August	< 3.0
September	< 3.0
October	< 2.1
November	< 2.1
December	< 2.1
Double determinations*.	

Table 2.4. Tritium in precipitation collected at Risø (cf. Fig. 1). July - December 2014. (Unit: kBq m^{-2})

Month	Precipitation (m)	10 m^2 rain collector
July	0.037	0.096
August	0.064	< 0.193
September	0.091	< 0.274
October	0.141	< 0.297
November	0.034	< 0.072
December	0.099	< 0.208
Sum	0.466	< 1.137

Table 3.1. Radionuclides in sediment samples collected at Bolund in Roskilde Fjord. (cf. Fig. 3.1) July - December 2014. (Unit: Bq kg^{-1} dry)

Date	^{137}Cs	K*
10 July	1.2	18.7
*Unit: g kg^{-1} dry		

Table 4.1. Radionuclides in seawater collected in Roskilde Fjord (cf. Fig. 4.1) July - December 2014. (Unit: Bq m^{-3})

Date	^{137}Cs
10 July	12.0

Table 4.2. Tritium in seawater collected in Roskilde Fjord (Risø pier) (cf. Fig. 4.2) July - December 2014.

Month	kBq m^{-3}
July	< 3.0 *
September	< 3.0 *
December	< 2.1 *
* Double determinations	

.

Table 5.1. Radionuclides in grass (snow) collected at Risø (near the Waste Treatment Station (cf. Fig. 1)), July - December 2014. (**Measured on bulked ash samples)*

Week no. or month	Date	K (g kg^{-1} fresh)	^{137}Cs (Bq kg^{-1} fresh)	^{137}Cs (Bq m^{-2})
27	30 June	6.0	< 0.6	
29	14 July	3.6	< 0.4	
31	28 July	6.3	< 0.7	
33	11 August	4.5	< 0.7	
35	25 August	3.4	< 1.0	
37	08 September	4.5	< 0.5	
39	22 September	3.4	< 0.8	
41	6 October	6.3	< 0.6	
43	20 October	3.7	< 0.5	
45	3 November	4.2	< 0.6	
47	17 November	4.0	< 0.4	
49	1 December	4.5	< 1.6	
51	15 December	3.7	< 1.4	
53	30 December	-	< 0.2	
**July		4.2	0.048	0.030
**August		4.3	0.138	0.023
**September		4.1	0.097	0.032
**October		4.8	0.224	0.066
**November		4.5	0.353	0.103
**December		-	-	-

Table 5.2. Radionuclides in Fucus vesiculosus collected at Bolund in Roskilde Fjord. July - December 2014. (Unit: Bq kg^{-1} dry)

Date	^{137}Cs	K*	% dry matter
10 July	2.4	24	22

*Unit: g kg^{-1} dry

Table 7.1. Waste water collected at Risø (cf. Fig. 1), July - December 2014.

Week number	eqv. mg KCl l^{-1}	^{137}Cs (Bq m^{-3})	^{131}I (Bq m^{-3})	^{226}Ra (Bq m^{-3})
27	105	< 112	< 107	< 193
28	80	< 157	< 96	< 184
29	74	< 111	< 114	< 224
30	70	< 110	< 107	< 216
31	72	< 109	< 116	< 211
32	68	< 110	< 114	< 222
33	61	< 111	< 113	< 203
34	58	< 121	< 123	< 234
35	58	< 121	< 119	< 222
36	58	< 108	< 113	< 213
37	77	< 108	< 117	< 222
38	66	< 106	< 110	< 204
39	76	< 93	< 92	< 175
40	66	< 72	< 73	< 152
41	57	< 60	< 64	< 121
42	85	< 138	< 143	< 293
43	34	< 75	< 72	< 145
44	44	< 80	< 70	< 152
45	70	< 80	< 82	< 163
46	65	< 89	< 78	< 152
47	57	< 92	< 84	< 174
48	85	< 75	< 75	< 148
49	74	< 73	< 68	< 146
50	90	< 80	< 74	< 152
51	-	< 82	< 77	< 158
52	-	< 71	< 215	< 151
Mean	68.8			
SD	15.0			

Table 8.1. Background dose rates around the border of Risø (cf. Fig. 8.1) measured with thermoluminescence dosimeters (TLD) in the period May - October 2014. (Results are normalized to nSv h^{-1})

Location	nSv h^{-1}
1	39
2	41
3	36
4	52
5	76
6	48
Mean	49

Table 8.2. Background dose rates around Risø (cf. Fig. 8.2 and Fig. 1) measured with thermoluminescence dosimeters (TLD) in the period May – October 2014. (Results are normalized to nSv h^{-1})

Risø zone	Location	nSv h^{-1}
I	1	39
I	2	47
I	3	71
I	4	37
I	5	52
Mean		42
II	P1	43
II	P2	59
II	P3	49
II	P4	57
Mean		52
III	P1	51
III	P2	48
III	P3	55
Mean		51
IV	P1	35
IV	P2	35
IV	P3	45
IV	P4	48
IV	P5	39
IV	P6	45
IV	P7	60
Mean		44
V	P1	-
V	P2	56
V	P3	62
V	P4	40
V	P5	59
V	P6	60
V	P7	55
V	P8	55
V	P9	54
V	P10	52
Mean		55

Table 8.3. Terrestrial dose rates at the Risø zones (cf. Fig. 8.2 and Fig. 1) July - December 2014. Measured with a NaI(Tl) detector. (Unit: nSv h^{-1})

Risø zone	Location	October
I	P1	43
I	P2	52
I	P3	360
I	P4	48
I	P5	70
Mean		115
II	P1	43
II	P2	49
II	P3	44
II	P4	43
Mean		45
III	P1	46
III	P2	50
III	P3	44
Mean		46
IV	P1	40
IV	P2	45
IV	P3	45
IV	P4	53
IV	P5	36
IV	P6	43
IV	P7	60
Mean		46
V	P1	51
V	P2	52
V	P3	51
V	P4	53
V	P5	54
V	P6	49
V	P7	46
V	P7a	47
V	P8	58
V	P9	58
V	P10	38
Mean		51

Fig. 1. Locations for measurements of gamma-background radiation Zone I and II (cf. Tables 8.2 and 8.3)

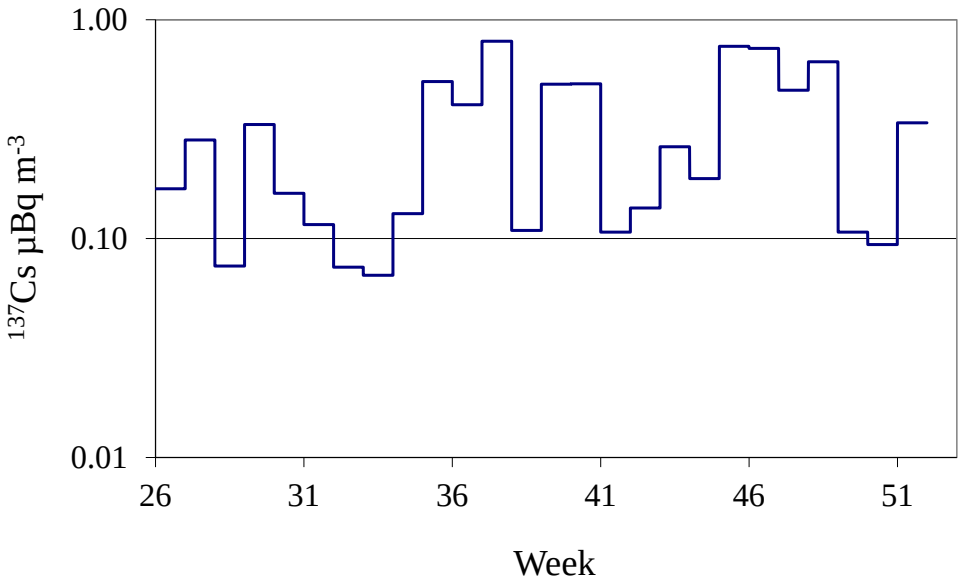

Fig. 1.1. Caesium-137 in ground level air collected at Risø in July-December 2014. (Unit: µBq m^{-3})

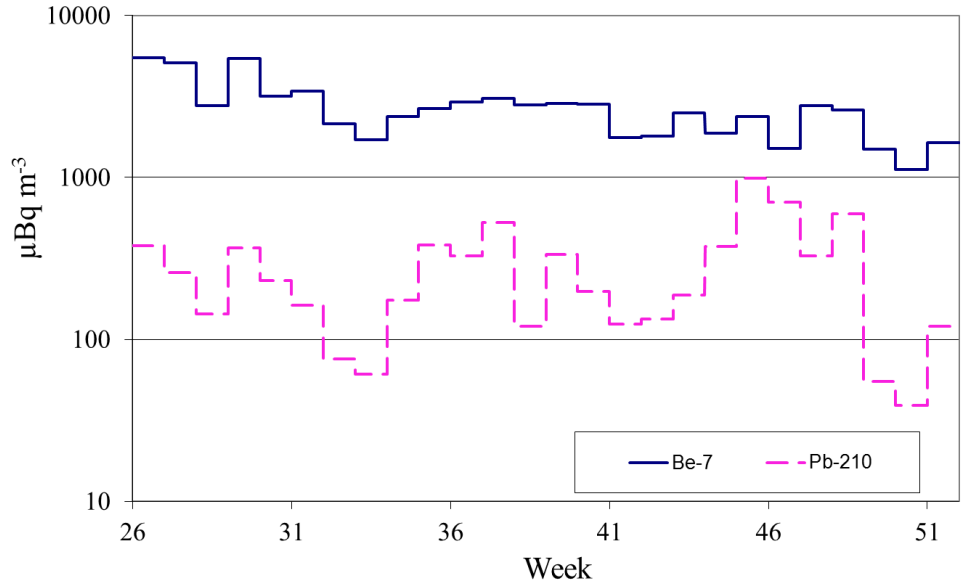

Fig. 1.2. Beryllium-7 and lead-210 in ground level air collected at Risø in July-December 2014. (Unit: µBq m^{-3})

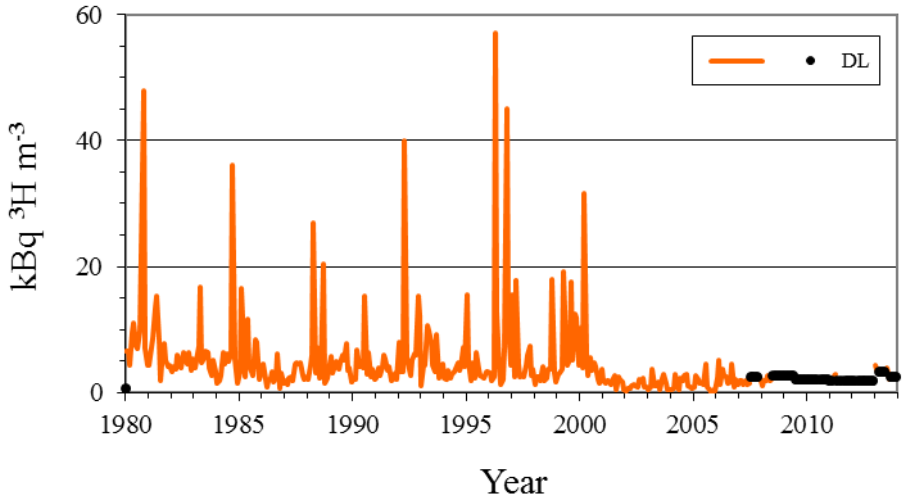

Fig. 2.3.1. Tritium in precipitation collected at Risø (1 m^2 rain collector) 1980 - 2013. (Unit: kBq m^{-3}; DL = detection limit). This rain collector was taken out of operation in 2013.

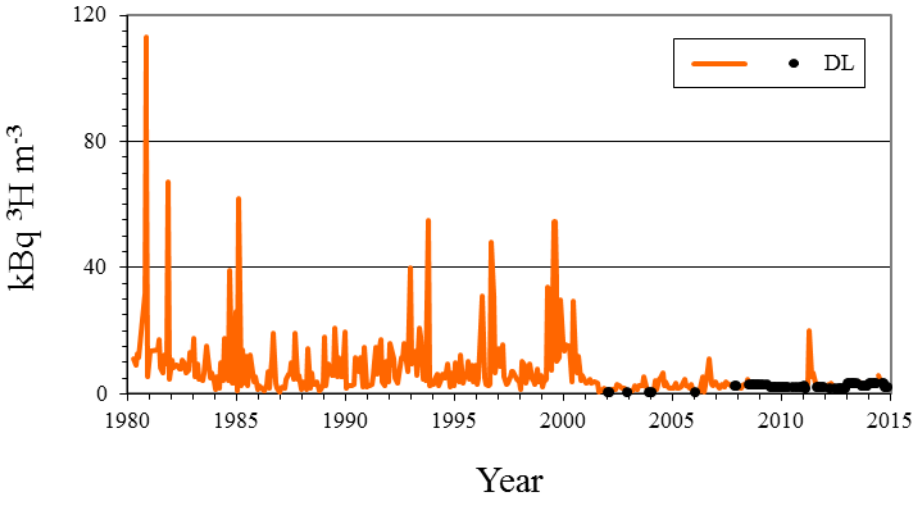

Fig. 2.3.2. Tritium in precipitation collected at Risø (10 m^2 rain collector) 1980 - 2014. (Unit: kBq m^{-3}; DL = detection limit)

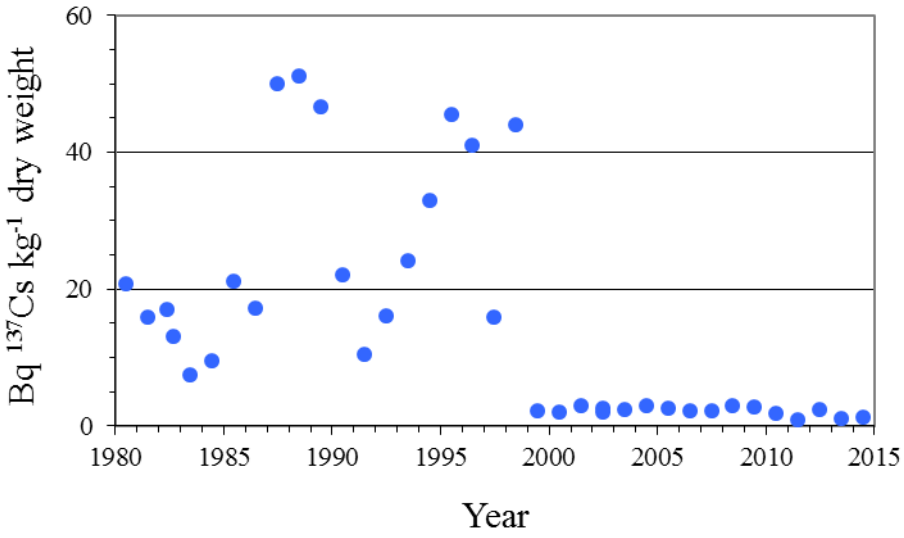

Fig. 3.1. Caesium–137 in sediment samples collected at Bolund in Roskilde Fjord. 1980 – 2014. (Unit: Bq kg^{-1} dry matter)

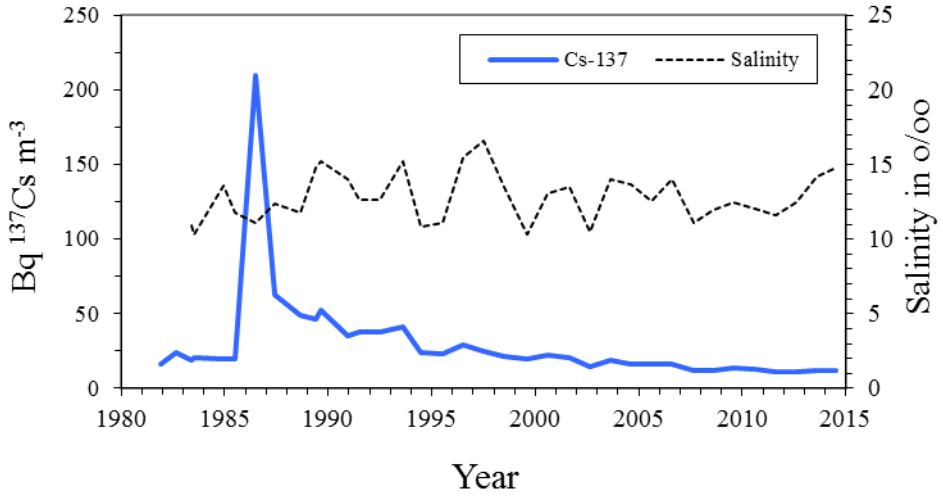

Fig. 4.1. Caesium–137 in seawater collected in Roskilde Fjord 1980 - 2014. (Unit: Bq m^{-3})

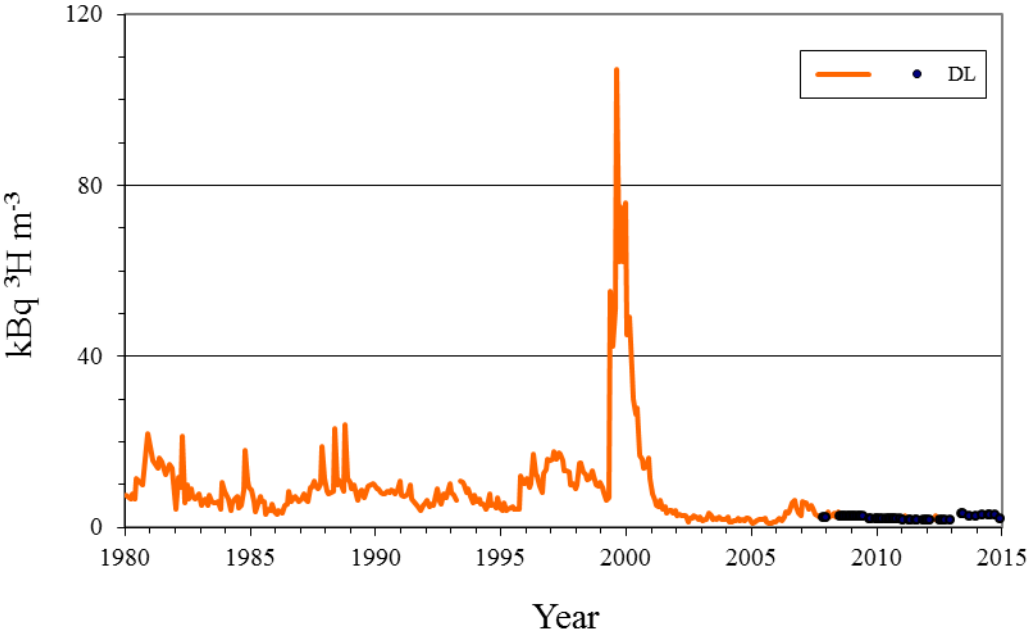

Fig. 4.2. Tritium in seawater collected in Roskilde Fjord 1980 - 2014. (Unit: kBq m^{-3}; DL = detection limit)

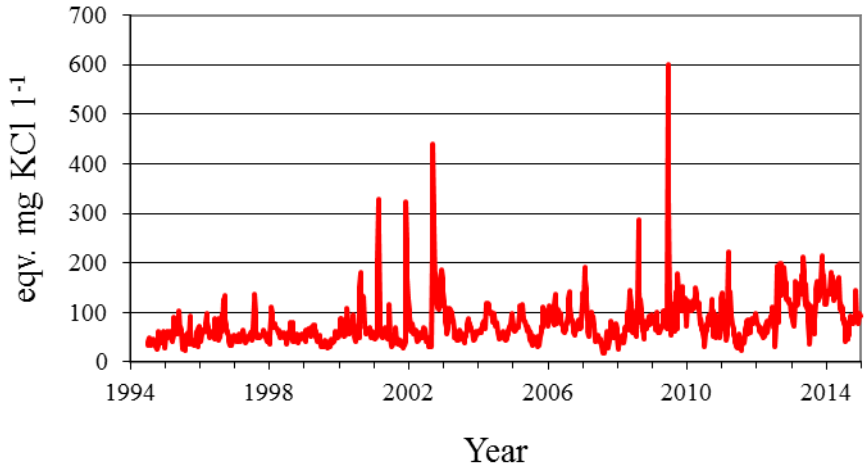

Fig. 7.1. Total-beta radioactivity in waste water collected at Risø 1994 - 2014. (Unit: eqv. mg KCl l^{-1})

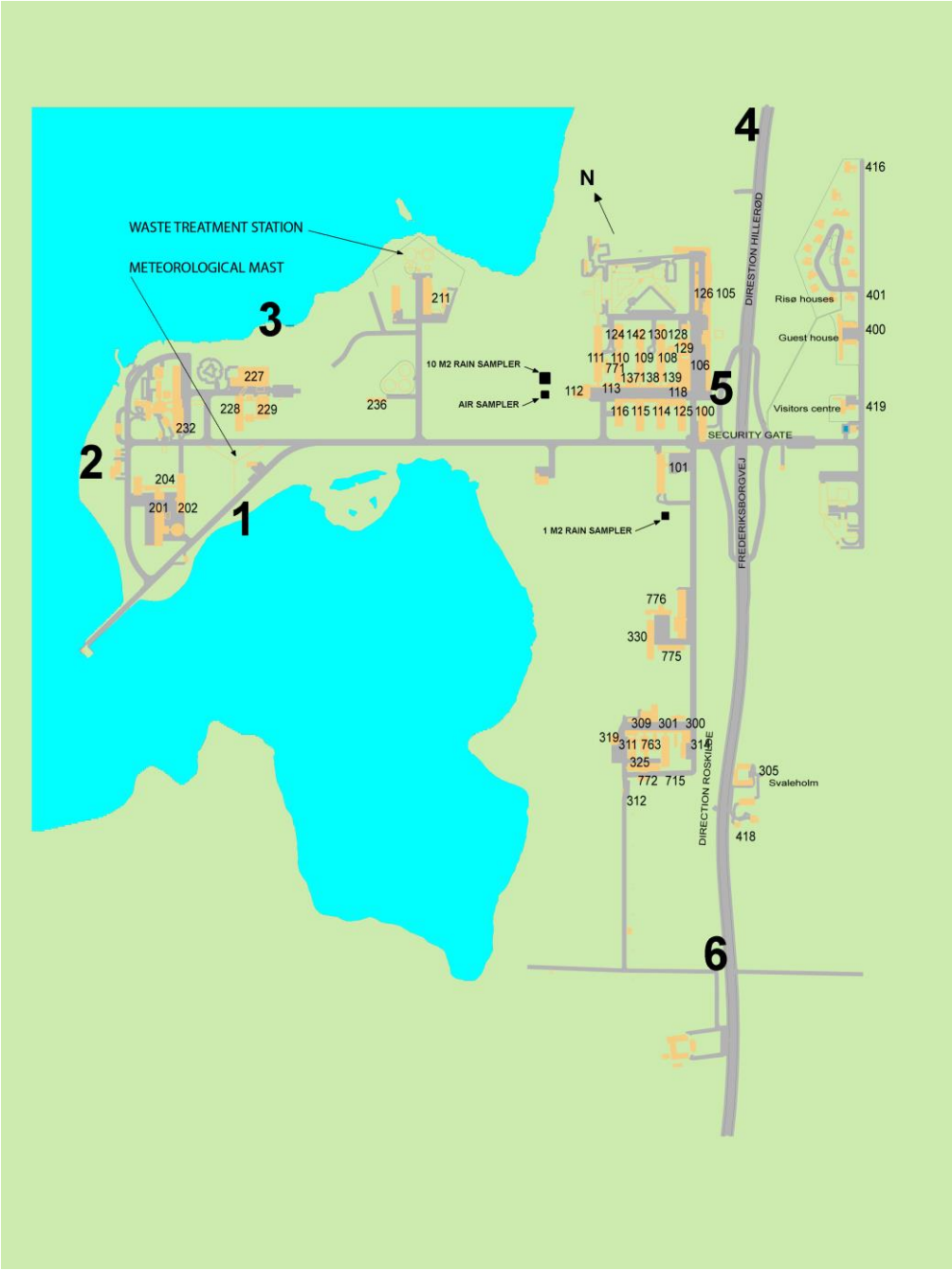

Fig. 8.1. Locations (1-6) for TLD measurements around the border of Risø (cf. Table 8.1).

Fig. 8.2. Locations for measurements of background radiation around Risø in Zones III, IV and V.

Center for Nuclear Technologies is Denmark's national competency center for nuclear technology. With roots in research in the peaceful use of nuclear power, DTU Nutech works with the applications of ionizing radiation and radioactive substances for the benefit of society.

DTU
Center for Nuclear Technologies
Technical University of Denmark

Frederiksborgvej 399
PO Box 49
DK-4000 Roskilde
Denmark
Phone +45 4677 4677
Fax +45 4677 5688

www.dtu.dk